C22F

CHANGING THE PHYSICAL STRUCTURE OF NON-FERROUS METALS AND NON-FERROUS ALLOYS (surface treatment of metallic material involving at least one process provided for in class C23 and at least one process covered by this subclass, C23F 17/00)

Definition statement

This place covers:

Changing the physical (metallurgical) structure of non-ferrous metals or alloys by heat treatment or by hot or cold working;

Changing the physical structure of non-ferrous metals or alloys by special physical methods, e.g. treatment with neutrons.

The term "non-ferrous alloys" refers to alloys based essentially on metals other than iron.

Relationships with other classification places

C21D provides for processes of modifying the physical structure of ferrous metals or alloys, general devices for heat treatment of ferrous or non-ferrous metals or alloys, and making ferrous metals or alloys malleable by decarburization, tempering or other metallurgical treatments.

C22F provides for decarburization of non-ferrous metal and non-ferrous alloys to modify the physical structure thereof. Subclass C22B covers the decarburization of metalliferous material for purposes of refining.

C23F 17/00 provides for surface treatment of metallic material involving at least one process provided for in class C23 and at least one process covered in C22F.

When the alloy is produced by a specifically described method (examples, claims), then the method is classified as well in the appropriate subclasses C21D, B22F, C23C, B23K, C25D, C25B, B22D, B21J, B21B, B21C etc.

When the alloy is intended for a particular use/product then the use/product is classified as well.

References

Limiting references

This place does not cover:

Working metallic powder, powder metallurgical apparatus or processes	B22F, C22C 1/04
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Electrolytic production or refining of metals	C25C
Single crystals or homogeneous polycrystalline material with defined structure; production thereof	C30B

Informative references

Attention is drawn to the following places, which may be of interest for search:

Jewellery	A44C
Biomedical applications, stents	A61F, A61L
Dental alloys	A61K

Catalysts	B01J
Mechanical metal-working	B21
Rolling of metal	B21B
Manufacture of metal sheets/bars/wires/tubes otherwise than by rolling	B21C
Working or processing of sheet metal or metal tubes, rods, or profiles without essentially removing material; punching	B21D
Forging	B21J
Casting of metals	B22D
Apparatus for mechanical working of metal	B23, B24
Soldering/Brazing/Welding compositions	B23K, B23K 35/00
Layered products	B32B
Lithographic printing plates	B41N
Vehicle parts	B62
Hydrogen storage alloys	C01B, H01M 4/38
Processing of pig iron, e.g. refining, manufacture of wrought iron or steel	C21C
General methods or devices for heat treatment, e.g. hardening, quenching, tempering	C21D 1/00
Alloys	C22C
Making alloys	C22C 1/00
Removing material from alloys to produce alloys of different constitution	C22C 3/00
Coating material with metallic material, cementation (carburizing, nitriding, etc)/Sputtering targets	C23C
Non-mechanical removal of metallic material from surfaces; inhibiting corrosion of metallic material; inhibiting incrustation in general; multi-step processes for surface treatment of metallic material	C23F 17/00
Steam turbines, turbine rotors Blades, turbine blades	F01D, F02C, F01D 5/00
Valve guides/valve seat inserts	F01L
Gas turbine plants	F02C
Bearings, shafts/crankshafts	F16C, F16C 23/00
Sliding member	F16J, F16K
Heat exchangers	F28F
Nuclear reactors/reactor fuel elements	G21C, G21C 3/04
Electrical wires	H01B
Magnets	H01F
Contacts	H01H
Semiconductor devices/detailsBonding wires, lead frames	H01L
Batteries	H01M
Electrical connectors	H01R
Electronic components	H05K

Special rules of classification

When the method is intended for providing a particular use/product then the use/ product is classified as well (see informative references for some of them).

When the composition of the alloy is disclosed, either in claims or description, the document is also classified in appropriate groups of subclass C22C.

Processes concerning SMA alloys (shape memory alloys) having the ability when originally shaped at a first temperature and reshaped at a second temperature to undergo a reversible thermoelastic transition and resume its original shape when returned to the first temperature or an intermediate temperature are covered by C22F 1/006 as well as C22F 1/10 and C22F 1/08

The phrase "based on" indicates in general at least 50% by weight of the specified constituent or of the specified group of constituents.

The base of the alloy in a broader sense is interpreted as the metallic element being the largest constituent of the alloy, regardless of whether or not any one element comprises at least 50 wt%. For example in an alloy with Ni-Ti (~55% Ni) , the base of the alloy is Ni and in an alloy with Co 40 wt%, Ni 30 wt% Al 30 wt%, the base of the alloy is Co.

In the case the alloy contains less than 50 wt% of each constituent, then in addition to the C22C corresponding to the major constituent(s), at least one C22C 30/00 group is also given depending on the rest of the main alloying elements.

In the groups C22F 1/04, C22F 1/16-C22F 1/18, C22F 3/00 the last place rule is followed (classification in the last appropriate place) combined with multiple classifications, for a classification of a 100% disclosed alloy composition.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Alloy	A composition of plural elements at least one of which is a free metal. It also includes material containing any combination of fibres, filaments, whiskers and particles, e.g. carbides, diamond, oxides, borides, nitrides, silicides, or other metal compounds, e.g. oxynitrides or sulfides embedded in a metallic matrix
Recrystallization	After all metal crystals have been dissolved by heating enough to lose its structural strength, the metal temperature then falls, allowing the crystals to re-form
Aging (or ageing)	A process in which the hardness or strength of a metal alloy having a constituent in supersaturated solid solution is increased over time as the constituent precipitates out as a secondary phase containing the constituent. When occurring at room temperature the process is termed "natural aging", while a process that occurs when subjecting the metal alloy to elevated temperature is termed "artificial aging". Aging for a longer time than that corresponding to maximum strength or hardness at the particular temperature is termed "over-ageing".
Hardening	The increase in resistance to deformation
Precipitation hardening	As the quenched alloy ages, a new material precipitates out of the metallic crystal lattice, filling in abutting spaces, and increasing hardness
Normalizing	A process of heating metallic material above its critical temperature and cooling in air thereby establishing a fine uniform grain size and improving the micro-structural uniformity

Quenching	The rapid cooling of metallic material either from elevated temperature to room temperature or cooling of metal to sub-ambient temperature, at a specific rate, with a given medium.
Tempering	Heating of a previously quenched or normalized metallic material to an elevated temperature, and then cooling under suitable conditions to obtain the desired mechanical properties.

Synonyms and Keywords

In patent documents the words "aging", "precipitation", "hardening" and "strengthening" are often used as synonyms.

It should be noted that these terms historically have specific definitions to those in the metallurgical arts.

C22F 1/00

Changing the physical structure of non-ferrous metals or alloys by heat treatment or by hot or cold working (apparatus for mechanical working of metal B21, B23, B24)

Definition statement

This place covers:

Methods of changing the physical structure of non-ferrous metals or alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

General methods or devices for heat treatment, e.g. hardening, quenching, tempering	C21D 1/00 - C21D 1/84, C21D 1/76
Alloy compositions	C22C 5/00 - C22C 5/10, C22C 9/00 - C22C 9/10, C22C 11/00 - C22C 11/10, C22C 19/03 - C22C 19/058
Alloy compositions	C22C 21/00- C22C 21/18, C22C 23/00 - C22C 23/06
Coating metallic material	C23C

Special rules of classification

In these groups, the last place rule is followed combined with multiple classifications.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

SMA alloys (shape memory alloys)	alloys having the ability when originally shaped at a first temperature and reshaped at a second temperature to undergo a reversible thermoelastic transition and resume its original shape when returned to the first temperature or an intermediate temperature
Quenching	Cooling of metallic material at a specific rate, with a given medium.

C22F 1/04

of aluminium or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of aluminium or aluminium alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy is classified in C22C 21/00-C22C 21/18 in the corresponding sub-group.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making aluminium alloys by powder metallurgy	C22C 1/0408 - C22C 1/0416

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/286, B23K 35/288
Alloys based on aluminium	C22C 21/00 - C22C 21/18

Special rules of classification

In these groups, the last place rule is followed combined with multiple classifications.

Depending on the next major constituent to Al, the corresponding C22F 1/00 class is given. In a case of more than one next major constituent(s), then more than one C22F 1/00 classes are given.

An Al-alloy with Si as the next major constituent comprising in addition Mg as alloying element is classified in C22F 1/043 but also in C22F 1/043 and corresponding C22C 21/00 classes. For example an alloy Al 60%, Si 21%, Mg 19%, will be classified in C22F 1/043 but also in C22F 1/043.

The alloy composition(s) is/are indexed in the Alloys database.

C22F 1/06

of magnesium or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of magnesium or magnesium alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy are classified as well in C22C 23/00-C22C 23/06 in the corresponding sub-group.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/284
Alloys based on magnesium	C22C 23/00 - C22C 23/06

C22F 1/08

of copper or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of copper or copper alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy is classified as well in C22C 9/00-C22C 9/10 in the corresponding sub-group.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0425

Informative references

Attention is drawn to the following places, which may be of interest for search:

Jewellery	A44C 27/00
Biomedical applications, stents	A61F, A61L
Soldering/welding materials	B23K 35/302
Alloys based on copper	C22C 9/00 - C22C 9/10

C22F 1/10

of nickel or cobalt or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of copper or copper alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy are classified as well in C22C 19/00-C22C 19/07 in the corresponding sub-group.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0408, C22C 1/0433, C22C 1/0441

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/3033, B23K 35/304, B23K 35/3046
Alloys based on copper	C22C 19/00 - C22C 19/07

C22F 1/11

of chromium or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of chromium or chromium alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy needs to be classified as well in C22C 27/06.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/045

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/32
Alloys based on chromium	C22C 27/06

C22F 1/12

of lead or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of lead or lead alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy is classified as well in C22C 11/00 - C22C 11/10.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0483

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/26
Alloys based on lead	C22C 11/00- C22C 11/10

C22F 1/14

of noble metals or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of noble metals or alloys based thereon by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

The alloy needs to be classified as well in C22C 5/00 - C22C 5/10

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0466

Informative references

Attention is drawn to the following places, which may be of interest for search:

Jewellery	A44C 27/00
Dental alloy	A61K
Catalysts	B01J
Soldering/welding materials	B23K 35/3006, B23K 35/3013, B23K 35/322
Alloys based on noble metals	C22C 5/00 - C22C 5/10

Special rules of classification

In this group, the last place rule is followed combined with multiple classifications. The alloy is classified as well in C22C 5/00 - C22C 5/10.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Noble metal based alloys	alloys with the noble metal (Ag, Au, platinum group) as the major constituent i.e. the base of the alloy

C22F 1/16

of other metals or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of other metals or alloys based thereon, i.e. with Zn, Cd, Ti, Zr by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04

Special rules of classification

In this group, the last place rule is followed combined with multiple classifications

C22F 1/165

{of zinc or cadmium or alloys based thereon}

Definition statement

This place covers:

Methods of changing the physical structure of zinc or cadmium or alloys based thereon, by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

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References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0483

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/266
Soldering/welding materials	B23K 35/282
Alloys based on zinc	C22C 18/00 - C22C 18/04

Alloys based on cadmium	C22C 20/00

Special rules of classification

In this group, the last place rule is followed combined with multiple classifications, respectively with C22C symbols for the alloy composition.

C22F 1/18

high-melting or refractory metals or alloys based thereon

Definition statement

This place covers:

Methods of changing the physical structure of refractory metal based alloys other than Ti-, Zr- based alloys i.e. with Re, V, Cr, Nb, Mo, Hf, Ta, W as the major constituent i.e. the base of the alloy, by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

When the alloy composition is disclosed, then it is classified as well in C22C 27/00- C22C 27/06.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/045

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/00
Alloys based on refractory metal	C22C 27/00- C22C 27/06

Special rules of classification

In this groups, the last place rule is followed combined with multiple classifications. Depending on the base of the alloy the appropriate C22F class is given combined with classification of said alloy in C22C.

C22F 1/183

{of titanium or alloys based thereon}

Definition statement

This place covers:

Methods of changing the physical structure of titanium or alloys based thereon i.e. with Ti as the major constituent i.e. the base of the alloy, by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0458

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/32
Alloys based on refractory metal	C22C 14/00

Special rules of classification

When the alloy composition is disclosed, then it is classified as well in C22C 14/00.

C22F 1/186

{of zirconium or alloys based thereon}

Definition statement

This place covers:

Methods of changing the physical structure of zirconium or alloys based thereon i.e. with Zr as the major constituent i.e. the base of the alloy, by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00
Making alloys by powder metallurgy	C22C 1/04, C22C 1/0458

Informative references

Attention is drawn to the following places, which may be of interest for search:

Soldering/welding materials	B23K 35/00
Alloys based on refractory metal	C22C 16/00

Special rules of classification

When the alloy composition is disclosed, then it is classified as well in C22C 16/00.

C22F 3/00

Changing the physical structure of non-ferrous metals or alloys by special physical methods, e.g. treatment with neutrons

Definition statement

This place covers:

Methods of changing the physical structure of non-ferrous metals or alloys by heat treatment or by hot or cold working which are not covered in any of B22F, B21B, B21J, C21D, C25C.

Relationships with other classification places

General methods or devices for heat treatments, e.g. annealing, hardening, quenching, tempering are classified in C21D 1/00

References

Limiting references

This place does not cover:

Methods of making alloys by powder metallurgy	B22F
Heat treatment, e.g. annealing, quenching, tempering, adapted for particular metallic articles; furnaces therefor	C21D 9/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

General methods or devices for heat treatments, e.g. annealing, hardening, quenching, tempering	C21D 1/00